

the *L. neglecta* of Alder, and is as graceful in form as it is fairy-like in size. The markedly flexuose character of the stem, the great length and narrowness of the cells, the plain margin, and the Lilliputian size, are the distinctive points.

IX.—On the Transformations of the Porcellanæ.

By Dr. FRITZ MÜLLER, of Desterro*.

[Plate I.]

FOR two years I have been acquainted with a *Zoëa* which is distinguished from its allies by the want of the dorsal spine and the unusual length of the straightly extended frontal horn; but it is only a few months since I found it to be the offspring of the same *Porcellana* whose extraordinary parasites I described in my recent memoirs†. In the mean time I met with opportunities of examining the young brood of two other *Porcellanidæ*. One of these is a smaller *Porcellana* with a nearly circular carapace, which occurs rarely on rocks amongst Polypes and Polyzoa; the other (Pl. I. figs. 1–3) lives parasitically upon some species of Starfishes, and differs so much from the true *Porcellanæ* in its whole appearance, in its claws, and especially in the shortness of the external antennæ, that I regard it as the representative of a peculiar genus, and call it *Porcellina stellicola* ‡.

As these *Porcellana*-larvæ agree in all essential characters with the *Zoëa*-form of the young Crabs, I leave their detailed description for a larger work on the young state of the Crabs, for which I have long been collecting materials, and confine myself at present to a superficial description of their structure.

The carapace is of an oval form, and covers not only the upper part and sides of the anterior unsegmented part of the body, but also the first five segments of the abdomen. From its anterior margin issues a straight spine or horn, which is as much as five times the length of the carapace (three times in the smaller *Porcellana*). Two similar spines extend straight backwards from the hinder margin of the carapace; these are usually parallel, but sometimes divergent in *Porcellina*; in the smaller *Porcellana* (fig. 10), in which they attain only two-thirds the length of the carapace, they are slightly bent downwards at the apex, and bear, near their origin, a considerable spine directed

* Translated by W. S. Dallas, F.L.S., from Wiegmann's Archiv, 1862, p. 194.

† See Annals, July and August 1862.

‡ Another *Porcellana* (*P. Creplinii*, n. sp.) is still more singular in its mode of life: it resides in pairs in the tube of *Chætopterus pergamentaceus*.

obliquely forwards and downwards; in the common *Porcellana* they are beset beneath with an entire series of small spines, and exceed the carapace in length; in *Porcellina* they attain more than three times the length of the carapace. Thus, in the latter species, the carapace of the newly-hatched young, with its processes, is twice as long as that of the mother.

Besides this remarkable carapace, the only structure which differs remarkably from other young Crabs is that of the last segment, which is dilated into a fin. It is well known that the last segment of the larvæ of Crabs is extended on each side into a horn, often of considerable size, and that in the emargination between these horns, three short plumose bristles usually stand on each side. In the *Porcellanæ* the lateral horns are replaced by inconspicuous spines, and the middle part projects so far between them that the whole tail acquires nearly a rhomboid form. In *Porcellina* this is particularly elongated, more than twice as long as broad. On each of the two posterior sides of the rhombus there are five long plumose bristles. (An intermediate form, but approaching most closely to the *Porcellanæ*, is presented by the tail of the young *Paguri*.)

In all other respects, in the structure of the eyes, antennæ, mouth, and feet, the young *Porcellanæ* agree entirely with the young Crabs, and exhibit no greater difference from them than the latter do among themselves.

In both, the anterior antennæ (Pl. I. fig. 5 a) are not jointed, and have a strong nervous knot in the vicinity of their apex, from which, besides a few minute bristles, two (three in *Porcellina*) longer peculiar filaments issue. These are of uniform thickness, or rarely a little tapering; they terminate in a rounded extremity, and are further distinguished from other bristles by their very delicate outline and dull turbidity. The same filaments, however, recur on the anterior antennæ of young *Bopyridæ* (they are especially distinct in *Entonitæ cancrorum*, n. sp.) and Cirripedes; in the latter they spring singly from a minute basal joint close to the eye.

The posterior antennæ (fig. 5 b) in *Porcellina stellicola* already exhibit a great resemblance to those of the mature animal (fig. 2) — the same inflated basal joint with the well-known opening of the still problematical sensorial organ, the same acutely triangular second joint, from the outside and upper part of which issues, in the one case, a multiarticulate flagellum, and in the other a simple spine-like process. The same pieces occur in the same form in the other species*.

* In the *Zoëa* of a small *Xantho*, the outer antennæ (fig. 11) attain the length of the frontal horn, and the future flagellum is so small as to be almost imperceptible.

The parts of the mouth (fig. 5) consist of a very large upper lip (*c*), of two strong sharply toothed mandibles, apparently without palpi (*d*), of a bipartite lower lip (*e*), and two pairs of maxillæ (*f*, *g*). The anterior maxilla (fig. 8) is split up into three, and the posterior one (fig. 9) into five leaves armed with strong bristles, which are partially denticulated or feathered; the latter also bears on the outside a larger membranous plate, which is produced posteriorly into a finger-like process; the process bears one, and the plate itself anteriorly and at the margin six, plumose bristles. This plate is bent upwards, and is in constant motion between the body and the carapace.

The two pairs of natatory feet consist of a strong cylindrical basal joint and two terminal rami; the inner ramus, which the animal is fond of extending forward, has four joints, and the outer one, which is usually turned outwards and upwards, two, less distinctly separated. At the extremity of the outer ramus stand four long plumose setæ; a single plumose seta is at the end of the third joint of the inner ramus of the last pair, and there are simple bristles on all the joints of the inner ramus of both pairs.

Behind the origin of the natatory feet commences the six-jointed abdomen, which bears no appendages; this separates from the carapace a little behind the middle of its upper part.

The stomach is somewhat dilated, and already exhibits (at least in *Porcellina*) longitudinal ridges beset with bristles; close to it on each side there are two hepatic cæca directed forwards, and two others directed backwards; the intestine has a straight course, and opens a little before the middle of the caudal segment.

The heart, situated at the posterior end of the thorax (in young Crabs under the origin of the dorsal spine), appears to be already formed exactly as in the mature animal, and to give off the same vessels. The anterior single vessel may be readily traced almost to the apex of the frontal horn, to the upper wall of which it is applied. Blood-corpuscles are exceedingly few in the first days (but this does not apply to all *Zoëæ*).

In each abdominal segment there is a ganglion of considerable size, united to its neighbours by two separate cords; in the anterior part of the animal I could not quite clearly make out the nervous system in its connexions.

If it be easy to procure in abundance the earliest stages of the most various Crustacea, it is all the more difficult to obtain a clue to their ultimate fate. Although the *Porcellanæ* are among the most generally distributed of Crustacea, I only one (in December of last year) met with an older larva (Pl. I. figs. 6, 7). At the spot where I found it, neither *Porcellina stelicola* nor

Porcellana Creplinii lived; but the larvæ of the common and of the smaller *Porcellanæ* are distinguishable at the first glance by the posterior processes of the carapace; and thus this larva may without hesitation be referred to the former species, from the earliest form of which it differs only by having twelve (instead of ten) setæ on the caudal segment, and by the presence of a pair of short inarticulate appendages on each of the four preceding segments. This single larva was, fortunately, uncommonly instructive, inasmuch as, being near its change of skin, it already showed the new limbs, with variable distinctness; within the old ones.

The new external antennæ had a multiarticulate flagellum; feet with large chelæ; and other members, which could not be completely made out, were situated *behind* the natatory feet; and within the caudal segment was a fan-shaped fin (fig. 7).

Hence, although the larva itself approaches closely to the earliest stage, the animal issuing from the next change of skin could scarcely differ essentially from the mature *Porcellana*.

So far my observations adapted for a preliminary communication. Their results may be summed up in a few short propositions:—

The *Zoëa*-form of the Crabs is completely destitute of the five pairs of true feet, and even of the segments bearing these.

The natatory feet of the *Zoëa* become the foot-jaws of the Crab.

The *Porcellanæ* are Crabs which have remained stationary at the *Megalops*-stage*.

EXPLANATION OF PLATE I.

Fig. 1. *Porcellina stelicola*, n. g. and sp.; magnified 5 diameters.

Fig. 2. Its external antenna; magn. 25 diam.

Fig. 3. Fifth pair of feet of the male; magn. 45 diam.

Fig. 4. Its youngest *Zoëa*-form, from above; magn. 15 diam.

Fig. 5. Cephalic portion of the preceding, from below; magn. 90 diam.:
a, anterior, and b, posterior antennæ; c, upper lip; d, mandible;
e, lower lip; f, first, and g, second pair of maxillæ.

Fig. 6. Older *Zoëa*-form of the common *Porcellana* of Santa Catharina; magn. 6 diam.

Fig. 7. Caudal extremity of the preceding; magn. 45 diam. In its interior is seen the fan-like caudal fin of the next state.

Figs. 8 & 9. First and second maxillæ of the youngest *Zoëa*-form of the common *Porcellana*.

Fig. 10. Posterior process of the carapace of the youngest *Zoëa*-form of a smaller *Porcellana*.

Fig. 11. External antenna of the youngest *Zoëa*-form of a small *Xantho*:
g, flagellum.

* Milne-Edwards even places *Megalops* and *Porcellana* in the same family.